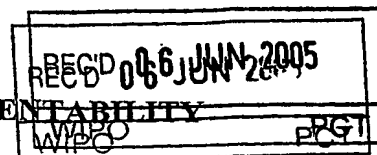


**PATENT COOPERATION TREATY**  
**PCT**  
**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**  
(Chapter II of the Patent Cooperation Treaty)  
(PCT Article 36 and Rule 70)



Applicant's or agent's file reference <b>256731/ARS/skp</b>	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. <b>CT/AU2004/000784</b>	International filing date (day/month/year) <b>15 June 2004</b>	Priority date (day/month/year) <b>16 June 2003</b>	
International Patent Classification (IPC) or national classification and IPC <b>Int. Cl. <sup>7</sup> F04D 29/22, 29/24, 7/04</b>			
Applicant <b>WEIR WARMAN LTD et al</b>			

- . This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- . This REPORT consists of a total of **3** sheets, including this cover sheet.
- . This report is also accompanied by ANNEXES, comprising:
- a. ☒ (sent to the applicant and to the International Bureau) a total of **2** sheets, as follows:
- ☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- |                                     |              |   |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I    | Basis of the report   |
| <input type="checkbox"/>            | Box No. II   | Priority  |
| <input type="checkbox"/>            | Box No. III  | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  |
| <input type="checkbox"/>            | Box No. IV   | Lack of unity of invention  |
| <input checked="" type="checkbox"/> | Box No. V    | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/>            | Box No. VI   | Certain documents cited   |
| <input type="checkbox"/>            | Box No. VII  | Certain defects in the international application  |
| <input type="checkbox"/>            | Box No. VIII | Certain observations on the international application   |

Date of submission of the demand <b>18 January 2005</b>	Date of completion of the report <b>31 May 2005</b>
Name and mailing address of the IPEA/AU <b>AUSTRALIAN PATENT OFFICE          PO BOX 200, WODEN ACT 2606, AUSTRALIA          E-mail address: pct@ipaaustralia.gov.au          Facsimile No. (02) 6285 3929</b>	Authorized Officer  <b>R. SUBBARAYAN</b> Telephone No. (02) 6283 2377

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2004/000784

## Box No. I Basis of the report

With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on translations from the original language into the following language which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1 (b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☐ the international application as originally filed/furnished

- ☒ the description:

pages 1-7 as originally filed/furnished

pages\* received by this Authority on with the letter of

pages\* received by this Authority on with the letter of

- ☒ the claims:

pages as originally filed/furnished

pages\* as amended (together with any statement) under Article 19

pages\* 8-9 received by this Authority on 1 March 2005 with the letter of 28 February 2005

pages\* received by this Authority on with the letter of

- ☒ the drawings:

pages 1/6-6/6 as originally filed/furnished

pages\* received by this Authority on with the letter of

pages\* received by this Authority on with the letter of

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2004/000784

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## Statement

Novelty (N)	Claims 1-15	YES
	Claims	NO
Inventive step (IS)	Claims 1-15	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-15	YES
	Claims	NO

## Citations and explanations (Rule 70.7)

None of the documents cited in the International Search Report disclose an impeller suitable for use in a centrifugal pump for handling liquid mixtures containing particulate solids, in which the dimension Da from the rotation axis to the outer peripheral edge portion of the shroud is greater than the dimension Db from the rotation axis to the outer edge portion of the auxiliary vanes Db and is greater than the dimension Dc from the rotation axis to the outer peripheral edge portion of the pumping vanes. The claimed invention is considered novel, inventive and industrially applicable.

- 8 -

## CLAIMS:

1. An impeller suitable for use in a centrifugal pump, for handling liquid mixtures containing particulate solids the impeller including a shroud having opposed faces, an outer peripheral edge portion and a rotation axis, a plurality of pumping vanes on one of the faces of the shroud and extending away from the rotation axis each pumping vane having an outer peripheral edge portion, and a plurality of auxiliary vanes on the other face of the shroud, the auxiliary vanes of each having an outer edge portion wherein the dimension  $D_a$  from the rotation axis to the outer peripheral edge portion of the shroud is greater than the dimension from the rotation axis to outer edge portion of the auxiliary vanes  $D_b$  and is greater than the dimension  $D_c$  from the rotation axis to the outer peripheral edge portion of the pumping vanes.
2. An impeller according to claim 1 wherein said shroud is a back shroud.
3. An impeller according to claim 2 wherein the impeller further includes a front shroud, the pumping vanes being between the front and back shrouds and the auxiliary vanes being on the other face of one of the shrouds.
4. An impeller according to claim 2 wherein the impeller further includes a front shroud, the pumping vanes being between the front and back shrouds and the auxiliary vanes being on the other face of each of the shrouds.
5. An impeller according to claim 3 wherein the dimension  $D_a$  of the front shroud is greater than the dimensions  $D_b$  and  $D_c$ .
6. An impeller according to claim 3 wherein the dimension  $D_a$  of the back shroud is greater than the dimensions  $D_b$  and  $D_c$ .
7. An impeller according to claim 3 wherein the dimension  $D_a$  of the front and back shrouds is greater than the dimensions  $D_b$  and  $D_c$ .

- 9 -

8. An impeller according to claim 4 wherein the dimension Da of the front shroud is greater than the dimensions Db and Dc.
9. An impeller according to claim 4 wherein the dimension Da of the back shroud is greater than the dimensions Db and Dc.
10. An impeller according to claim 4 wherein the dimension Da of the front and back shrouds is greater than the dimensions Db and Dc.
11. An impeller according to claim 5 wherein Db and Dc are substantially the same.
12. An impeller according to claim 11 wherein Db and Dc are within 5% of each other.
13. An impeller according to claim 12 wherein Db is less than 0.95 Da.
14. An impeller according to claim 13 wherein Db/Da is from 0.65 to 0.95.
15. An impeller according to claim 13 wherein Db/Da is from 0.65 to 0.9.

- 8 -

## CLAIMS:

1. An impeller suitable for use in a centrifugal pump, for handling liquid mixtures containing particulate solids the impeller including a shroud having opposed faces, an outer peripheral edge portion and a rotation axis, a plurality of pumping vanes on one of the faces of the shroud and extending away from the rotation axis each pumping vane having an outer peripheral edge portion, and a plurality of auxiliary vanes on the other face of the shroud, the auxiliary vanes of each having an outer edge portion wherein the dimension  $D_a$  from the rotation axis to the outer peripheral edge portion of the shroud is greater than the dimension from the rotation axis to outer edge portion of the auxiliary vanes  $D_b$  and is greater than the dimension  $D_c$  from the rotation axis to the outer peripheral edge portion of the pumping vanes.
2. An impeller according to claim 1 wherein said shroud is a back shroud.
3. An impeller according to claim 2 wherein the impeller further includes a front shroud, the pumping vanes being between the front and back shrouds and the auxiliary vanes being on the other face of one of the shrouds.
4. An impeller according to claim 2 wherein the impeller further includes a front shroud, the pumping vanes being between the front and back shrouds and the auxiliary vanes being on the other face of each of the shrouds.
5. An impeller according to claim 3 wherein the dimension  $D_a$  of the front shroud is greater than the dimensions  $D_b$  and  $D_c$ .
6. An impeller according to claim 3 wherein the dimension  $D_a$  of the back shroud is greater than the dimensions  $D_b$  and  $D_c$ .
7. An impeller according to claim 3 wherein the dimension  $D_a$  of the front and back shrouds is greater than the dimensions  $D_b$  and  $D_c$ .

- 9 -

8. An impeller according to claim 4 wherein the dimension Da of the front shroud is greater than the dimensions Db and Dc.
9. An impeller according to claim 4 wherein the dimension Da of the back shroud is greater than the dimensions Db and Dc.
10. An impeller according to claim 4 wherein the dimension Da of the front and back shrouds is greater than the dimensions Db and Dc.
11. An impeller according to claim 5 wherein Db and Dc are substantially the same.
12. An impeller according to claim 11 wherein Db and Dc are within 5% of each other.
13. An impeller according to claim 12 wherein Db is less than 0.95 Da.
14. An impeller according to claim 13 wherein Db/Da is from 0.65 to 0.95.
15. An impeller according to claim 13 wherein Db/Da is from 0.65 to 0.9.

- 8 -

CLAIMS:

1. An impeller suitable for use in a centrifugal pump, for handling liquid mixtures containing particulate solids the impeller including a shroud having opposed faces, an outer peripheral edge portion and a rotation axis, a plurality of pumping vanes on one of the faces of the shroud and extending away from the rotation axis each pumping vane having an outer peripheral edge portion, and a plurality of auxiliary vanes on the other face of the shroud, the auxiliary vanes of each having an outer edge portion wherein the dimension Da from the rotation axis to the outer peripheral edge portion of the shroud is greater than the dimension from the rotation axis to outer edge portion of the auxiliary vanes Db and is greater than the dimension Dc from the rotation axis to the outer peripheral edge portion of the pumping vanes.
2. An impeller according to claim 1 wherein said shroud is a back shroud.
3. An impeller according to claim 2 wherein the impeller further includes a front shroud, the pumping vanes being between the front and back shrouds and the auxiliary vanes being on the other face of one of the shrouds.
4. An impeller according to claim 2 wherein the impeller further includes a front shroud, the pumping vanes being between the front and back shrouds and the auxiliary vanes being on the other face of each of the shrouds.
5. An impeller according to claim 3 wherein the dimension Da of the front shroud is greater than the dimensions Db and Dc.
6. An impeller according to claim 3 wherein the dimension Da of the back shroud is greater than the dimensions Db and Dc.
7. An impeller according to claim 3 wherein the dimension Da of the front and back shrouds is greater than the dimensions Db and Dc.

- 9 -

8. An impeller according to claim 4 wherein the dimension Da of the front shroud is greater than the dimensions Db and Dc.
9. An impeller according to claim 4 wherein the dimension Da of the back shroud is greater than the dimensions Db and Dc.
10. An impeller according to claim 4 wherein the dimension Da of the front and back shrouds is greater than the dimensions Db and Dc.
11. An impeller according to claim 5 wherein Db and Dc are substantially the same.
12. An impeller according to claim 11 wherein Db and Dc are within 5% of each other.
13. An impeller according to claim 12 wherein Db is less than 0.95 Da.
14. An impeller according to claim 13 wherein  $Db/Da$  is from 0.65 to 0.95.
15. An impeller according to claim 13 wherein  $Db/Da$  is from 0.65 to 0.9.